JITTA

JOURNAL OF INFORMATION TECHNOLOGY THEORY AND APPLICATION

"SOFTWARE OF THE MIND" – A REVIEW OF APPLICATIONS OF HOFSTEDE'S THEORY TO IT RESEARCH

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ABSTRACT

We review applications of Hofstede's cultural theory to IT research. The objective of this paper is to integrate disparate applications of Hofstede's framework in IT research and provide a detailed synthesis of the existing literature grouped by specific IT areas across each of Hofstede's cultural dimensions. In this review we carry out an exhaustive quantitative and qualitative analysis of articles that applied Hofstede's framework to IT-related research and find that, despite inherent limitations, a national culture perspective has proven useful to all areas of IT-research. We also identify gaps in the existing literature and propose several streams of potential research. Some gaps are due to recent developments in Hofstede's framework. Long-Term Orientation, for example, is a recent development and has been applied to IT-research in only a few instances. Other gaps are due to the sporadic and seemingly random application of Hofstede's framework to IT-research. There are only a few instances, for example, of applications of Hofstede's framework to software development research. The findings of this review will benefit IT researchers wishing to conduct cultural research and will allow researchers to uncover differences and similarities in complex populations that characterize today's IT-enabled workforce. By using value-based cultural indicators, such as

Tuure Tuunanen acted as the senior editor for this paper.

Gaspay, A., S. Dardan, and L. Legorreta, "'Software of the Mind' – A Review of Applications if Hofstede's Theory to IT Research," *Journal of Information Technology Theory and Application (JITTA)*, 9:3 2008,1-37.

the dimensions developed by Hofstede (2001), researchers can readily examine a variety of important issues facing the field of IT in today's global environment.

INTRODUCTION

In the emerging global environment diversity is playing an increasingly important role. More and more often organizations are trying to boost their competitive advantage by utilizing outsourcing, cross-cultural teams, and other international relationships. This phenomenon is also reflected in the increased demographic diversity of the US. According to Census Bureau, US demographics are undergoing a rapid change. As Figure 1 shows, the immigrant population in the US comes from many diverse regions, and comprises 12.4% of the total US population.

One of the consequences of globalization is the increased need for people from different cultural backgrounds to work with each other. In the IT context, to effectively use various technologies and to enable valuable relationships and collaborations, organizations will gain from understanding the role culture plays in conceptualizing, inventing, adapting, and defining information technologies.

Much of what we enjoy from a given technology may depend on our cultural heritage. What technologies one culture may find enjoyable and worthy of diffusion, may be seen as frivolous and unimportant by the next. The iPod took the United States by storm, but has had success mitigated by strong rivals in Korea. If we are to understand the effectiveness of information technologies, we must grapple with the impact culture has on individuals' attitudes towards these tools. Hence in this study we set out to review applications of cultural theories to IT-related research. We found that among competing cultural frameworks Hofstede's framework is the most widely used in IT research. We believe that Hosfstede's value-based perspective is appropriate to understand the role culture plays in an increasingly global economy, but note that other perspectives are needed if we are to manage this complex and important subject, the interrelationship between culture and IT.

Dutch scientist Geert Hofstede (2001) defines culture as "the collective programming of the mind that distinguishes the members of one group or category of people from others" and examines culture from a value-based perspective. For Hofstede (2001), cultural patterns remain stable. From his perspective, culture is viewed as a homeostatic (self-regulating) quasi-equilibrium. Alternative perspectives view culture as more fluid. For example, Myers and Tan (2002) view culture as something that is invented and re-invented and always in a state of flux.

Since the vast majority of research in this area uses Hofstede's framework, we made applications of Hofstede's framework to IT-related research focus of our review. We begin by giving a brief overview of alternative

CONTRIBUTION

This review points IT researchers towards value-based cultural determinants developed by the Dutch scientist Geert Hofstede and illustrates the versatility of this approach. It also shows that culture has stable as well as unstable components, even when limited to the value-based perspective (Myers and Tan 2002). This paper contributes to the body of knowledge by integrating disparate applications of Hofstede's framework to IT research. This integration is achieved through exhaustive quantitative and qualitative synthesis of the existing literature in the area of IT that relies on Hofstede's theory. In addition, we identify several streams for future research, show importance of including dynamic perspectives offered by Myers and Tan (2002) and Jones and Alony (2007), and confirm that Hofstede's theory is an excellent tool for business. This paper benefits anyone doing IT research from the cultural perspective by allowing them to uncover differences and similarities in complex populations, such as today's IT-enabled workforce.

cultural theories, and note that these have rarely been applied to the IT field. Next, we summarize Hofstede's dimensions of culture and review critiques of his work. From this background we carry out a quantitative analysis and a qualitative analysis of the applications of his model to IT research. We conclude by identifying potential directions for future research and by highlighting the business benefits of this approach.

ALTERNATIVE CULTURAL MODELS

The concept of culture is originally rooted in anthropology (Zakour 2003). Current body of cultural research is based on the work of several key researchers; chief among, Edward T. Hall, Kluckhohn and Strodtbeck, Trompenaars and Hampden-Turner, Schwartz, and Geert Hofstede.

Edward T. Hall wrote two seminal works *Beyond Culture* (1989) and *Hidden Differences* (1987), in which he identified two dimensions of culture: high-context versus low-context and polychromic versus monochronic. The high versus low context concept is primarily concerned with the way in which information is transmitted (Dahl 2004). Polychronic versus monochronic time orientation deals with the ways in which cultures structure their time (Dahl 2004). In addition, Hall (1987) identified perception of space, which he categorized as intimate, social, or public. Hall's work is widely used in business and mass communication research. Hall's work is clearly relevant to IT research, but it has been rarely applied. Hall's constructs are well established and widely used in other fields. They may fit well within Myer and Tan's appeal for a new perspective in IT-related cultural research. The same observation applies to other value-based cultural frameworks, including Kluckhohn and Stodtbekc (1961) and Trompenaars and Hampden-Turner (1998).

Kluckhohn and Strodtbeck (1961) developed the foundations for the Value Orientations Method (VOM), which proposes that one can distinguish cultures based on how they address five universal human concerns: human nature, man-nature relationship, time sense, activity, and human relations (Gallagher 2001). Given its perspective it is difficult to find ready applications of VOM to IT research, but certainly not impossible. There are extremely few instances of applications of VOM to IT research.

Trompenaars and Hampden-Turner (1998) classified cultures along a mix of behavioral and value patterns and focused their research on the cultural dimensions of business executives (Dahl 2004). Although this classification grew out of management research, it has not seen many applications in business IT.

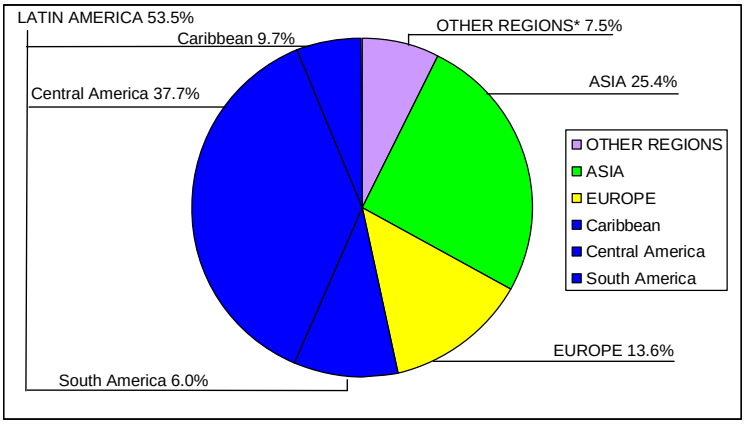


Figure 2. US Foreign Born Population by Region of Birth – 2004 (in percent)
*** includes Northern America, Africa, and Oceania**

Source: US Census Bureau (2004)

Schwartz (1994) took a different approach to finding (cultural) value differences. His "SVI" (Schwartz Value Inventory) asks respondents to assess how important a list of 57 values are as "guiding principles of one's life" (Dahl 2004). Schwartz's work is separated into individual-level and culture-level analyses, which makes the SVI markedly distinct from the other models including those of Trompenaars/Hampden-Turner and Hofstede. Despite its versatility, the SVI is rarely used in IT research.

In sharp contrast to all the alternative cultural frameworks, Hofstede's framework is widely accepted and used in IT research. This is a serious gap in the literature. Filling this gap may go along way in addressing the concerns raised by Myers and Tan (2002) and Jones and Alony (2007). Next we explore the application of Hofstede's work to IT research in detail. We begin with an overview of his framework.

CULTURAL THEORY OF GEERT HOFSTEDE

This review focuses on Hofstede's theory because it dominates (national) cultural research in IT. In 1980, Geert Hofstede introduced a national cultural framework based on data collected in two survey rounds between 1967 and 1973 (Yamamura, Satoh and Stedham 2003) and developed a set of dimensions to characterize the concept of national culture (Zakour 2003).

Hofstede's dimensions have several advantages. First, Hofstede's dimensions rely on variables that are more directly linked to social and organizational processes by focusing on human values, rather than on general beliefs and practices (Zakour 2003). Second, Hofstede's constructs although tied to national characteristics are abstractions that lend themselves well to applications. Third, Hofstede's dimensions are the most widely used and accepted in cross-cultural research not just in IT but generally; they have become a defacto standard. Forth, Hofstede's work has been validated directly or indirectly by many other researchers (Zakour 2003).

Hofstede (2001) defines culture as "the collective programming of the mind that distinguishes the members of one group or category of people from others." His cultural framework identified five dimensions of culture: (1) Power Distance (PDI), which is related to the difference in solutions to the basic problem of human inequality; (2) Uncertainty Avoidance (UAI), which is related to the level of stress in a society in the face of an unknown future; (3) Individualism (IDV) vs. Collectivism, which is related to the integration of individuals into primary groups; (4) Masculinity (MAS) vs. Femininity, which is related to the division of emotional roles between men and women; and (5) Long-Term Orientation (LTO) vs. Short-Term Orientation, which is related to the choice of focus for people's efforts: the future or the present (Hofstede 2001, Hofstede and Bond 1988). Table 1 summarizes five cultural dimensions of Geert Hostede.

Hofstede empirically discovered and validated each dimension. As a result, each country can be positioned on an axis represented by each dimension and assigned an index value. Initially, 50 countries and three regions received index values. However, in his latest book, *Cultures and Organizations: Software of the Mind* (2005), which Hofstede co-authored with his son, Gert Jan Hofstede, additional index values were developed based on replications and estimates. Consequently, Hofstede's latest research contains values for 74 countries and regions. Total list of countries surveyed by Hofstede and their corresponding indices are shown in Appendix A.

The constructs are not independent. For example, Appendices B and C include two graphical representations that illustrate the correlation between Power Distance and Uncertainty Avoidance, and between Power Distance and Individualism, respectively. Nonetheless, the dimensions are statistically distinct and occur in all possible combinations, although some combinations are more frequent than others (Hofstede 2001). Hofstede believes these national cultural characteristics to be enduring and relatively stable over time (Yamamura, Satoh and Stedham 2003).

Table 1. Five Dimensions of Culture

Cultural Dimension	*Definition*
Power Distance	Power Distance is the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally.
Uncertainty Avoidance	Uncertainty Avoidance is defined as the extent to which the members of a culture feel threatened by ambiguous or unknown situations.
Individualism vs. Collectivism	Individualism pertains to societies in which the ties between individuals are loose: everyone is expected to look after himself or herself and his or her immediate family. Collectivism, its opposite, pertains to societies in which people from birth onward are integrated into strong, cohesive in-groups, which throughout people's lifetime continue to protect individuals in exchange for unquestioning loyalty.
Masculinity vs. Femininity	A society is called masculine when emotional gender roles are clearly distinct: men are suppose to be assertive, tough, and focused on material success, whereas women are suppose to be more modest, tender, and concerned with the quality of life. A society is called feminine when emotional gender roles overlap: both men and women can be modest, tender, and concerned with quality of life.
Long- vs. Short-Term Orientation	Long-Term Orientation stands for the fostering of virtues oriented toward future rewards – in particular perseverance and thrift. Its opposite pole, short-term orientation, stands for fostering of virtues related to the past and present – in particular, respect for tradition, preservation of "face," and fulfilling social obligations.

Source: Hofstede and Hofstede (2005)

CRITIQUE OF HOFSTEDE'S THEORY

Criticism of Hofstede's differentiation into national cultures and national markets is based on the apparent homogenizing effect of globalization (Hermeking 2005). As Hewling (2005) highlighted, an increase in cross-border movement of people around the world means that many individuals are operating within at least two nation-based frames of cultural reference.

Hofstede's response to this criticism can be found in the latest edition of *Cultures and Organizations* (2005). Relying on the definition of culture as *mental programming* or *software of the mind*, Hofstede and Hofstede (2005) argue that most of these programmed patterns of thinking are formed early in childhood, because the sources of one's mental programs lie within the social environment in which one grew up and collected life experiences. The core of culture, according to Hofstede and Hofstede (2005), is formed by *values*, defined as tendencies to prefer certain states of affairs over others. The term *practices* for Hofstede and Hofstede (2005) are merely the visible part of culture: the collection of symbols (such as words, gestures, pictures, or objects); heroes (such as persons, alive or dead, real or imaginary); and rituals (such as collective activities). Unlike values, practices are formed later in life and are much easier to change. Figure 2 shows the distinction between values and practices.

Critics of Hofstede's theory do not always differentiate between values and practices. Therefore, it could be argued that person's practices are easily changed through the homogenizing effect of globalization; however, values as defined by Hofstede change little. As Hofstede pointed out, if young Turks drink Coca-Cola, this does not necessarily affect their attitudes toward authority nor their view on gender roles. Consequently, even if the person relocates to a different culture his or her values are likely to

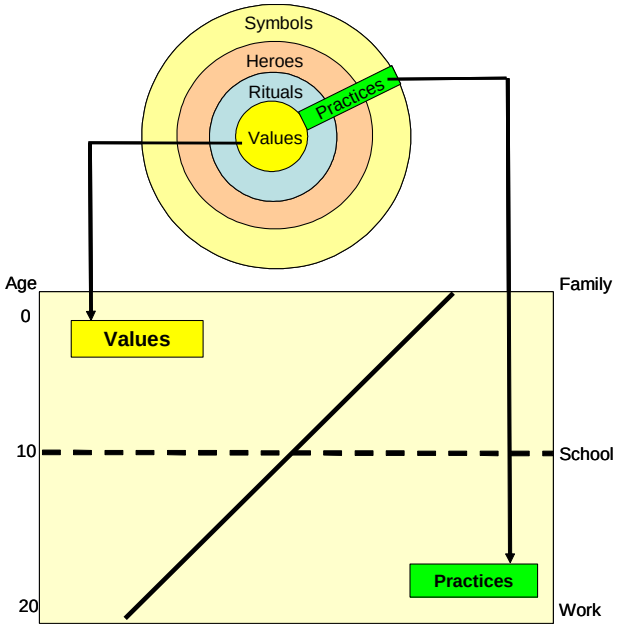


Figure 2. The Learning of Values and Practices

Adapted from Hofstede and Hofstede (2005)

remain relatively stable, perhaps even over generations. This distinction between values and practices has important implications for research in the technology area. Hofstede and Hofstede (2005) highlight, "There is no doubt that dazzling technological changes are taking place that affect all but the poorest or remotest of people. But people put these new technologies to familiar uses." We will use technology as we see fit within our cultural paradigms, perhaps even use IT to extend and perpetuate these paradigms. This places Hofstede's framework in an important cornerstone position.

In addition, critics point out that even within any given culture, there is a myriad of minority subcultures which could be very distinct from the majority culture. To clarify why diversity within cultures (such as ethnic and religious minorities) does not negate the concept of *national* culture Hofstede and Hofstede (2005) took a historical perspective and asserted that national and regional differences today still partly reflect the boarders of former empires. They demonstrated that Latin cultures, for instance, hold common traits derived from the Roman Empire, and that Chinese cultures reflect the inheritance of the Chinese Empire. Further, within nations that existed for some time there are strong forces toward integration: (usually) one dominant national language, common mass media, a national educational system, etc. (Hofstede and Hofstede 2005). "Even if a society contains different cultural groups (such as blacks, Hispanics, Asians, and Caucasians in the United States), these usually share certain cultural traits with one another that make their members recognizable to foreigners as belonging to that society (Hofstede 2001)." Moreover, religious minorities are alleged to be a result of previously existing cultural differences, rather than the cause of these differences (Hofstede and Hofstede 2005).

Another common critique of Hofstede's work is that it relied on interviews with IBM employees in the 1960's and 1970's, thus raising questions of applicability of his finding to national culture (Ess and Sudweeks 2005). However, Hofstede and Hofstede (2005) argue that IBM employees were an excellent population to study cultural differences precisely because they were so similar in all other ways except their culture. Thus, subjects'

similarities magnified their difference at the level of culture and allowed Hofstede to extract and statistically validate those differences.

Lastly, some researchers insist that within any particular culture values may vary to a great degree among members of a society. However, Hofstede never claimed that his dimensions are designed to measure cultural values at an individual level. Hofstede insists that cultural dimension index values accurately reflect cultural values of a group of individuals that share the same national culture.

Despite these concerns, Hofstede's theory has been widely accepted and adopted. Next we examine the applications of his theory to IT research in detail.

APPLICATIONS OF HOFSTEDE'S THEORY IN IT RESEARCH

In this section we carry out a Quantitative Synthesis and a Qualitative Synthesis of the existing literature in the area of IT and review Representative Studies of applications of Hofstede's theory in this area.

Quantitative Synthesis

We found 50 IT articles that use Hofstede's framework. We find that his framework has been applied in the areas of :

- IT adoption and diffusion (Jarvenpaa and Leidner 1998; Zakour 2003; Hwang 2004; Van Everdingen and Waarts 2003; Yeniyurt and Townsend 2003; Yaveroglu and Donthu 2002; Dwyer, Mesak and Hsu 2005; Lynn and Gelb 1996),
- IT use and outcomes (Lippert and Volkmar 2007),
- Information Systems (IS) development (Kankanhalli, Tan, Wei and Holmes 2004),
- Internet and e-commerce (Barnett and Sung 2005; Gefen and Heart 2006; Gong, Li and Stump 2007; Hermeking 2005; Lim 2004; An and Kim 2007),
- Website design (Marcus and Gould 2000; Callahan 2005),
- Technology-mediated communication (Kersten, Koeszegi and Vetschera 2003; Lim and Yang 2007; Hewling 2005; Hornik and Tupchiy 2006; Tung and Quaddus 2002), and
- IT management and strategy (Husted 2000).

Each of the 50 articles reviewed focused on a single area of IT research; and some only focused on select Hofstede's cultural dimensions. Some studies established clear relationships between the Hofstede dimensions and their variables of interests; while others made only general conclusions about the applicability of Hofstede's framework. In Table 2 we grouped the articles by area of IT research and by Hofstede Cultural Dimension and counted the results.

Among these articles a large number focus on *IT adoption and diffusion*. This finding is not surprising for two reasons. First, Hofstede's framework lends itself well to adoption research. Just as Hofstede's framework is widely used in marketing

Table 2: Results Summary by Area and Dimension

IT-related area	*PDI*	*UAI*	*IDV*	*MAS*	*LTO*	*Total**
Information Systems development	1	2	3	2	-	**8**
Internet/ E-commerce	3	2	2	2	1	**10**
IT adoption and diffusion	11	10	8	5	2	**36**
IT management and strategy	4	5	7	4	-	**20**
IT use and outcomes	5	7	7	5	-	**24**
Technology-mediated communication	4	3	5	2	-	**14**
Website design	3	3	4	4	1	**15**
Total *	**31**	**32**	**36**	**24**	**4**	

* These totals represent results, not studies. A given study may have more than one result.

research, viewing IT adoption as a product placement issue, it makes sense to inquire about the cultural nature of the target user. Second, given the success of the Technology Acceptance Model (Davis 1989; Venkatesh and Davis 2000), it makes sense that this sub-area of IT research is equally dominated by adoption results.

Equally noticeable are the gaps. See Figure 3. For example, the *Internet/e-commerce* area is not very mature. This can be due to two reasons. First, the Internet is relatively new compared to other areas such as *IT adoption and diffusion*, *IT management and strategy*, and *IT use and outcomes*. The Internet has been around for a long time, but has been used for commercial purposes recently. On the other hand, we have been developing and using business information systems since the early 1950s. Second, collecting data about Internet use is not as easy as it is about other information technologies. Most scientific studies will develop according to how easy it is to obtain results. IS research is no different. The above table, in fact, illustrates that certain areas have developed ahead of others, perhaps for this reason.

The area of *information systems development* is the least complete among examined IT-related areas. This is surprising, considering that many software development projects today utilize cross-cultural teams and many companies outsource their IS functions to other nations.

Lastly, the gap in Long-Term Orientation related studies is noticeable. This is perhaps due to the fact that Hofstede introduced this dimension later. Currently the LTO index is known for only a handful of countries. See Figure 3 and Appendix A.

Qualitative Synthesis

The Power Distance dimension was widely used in IT research, especially in the area of *IT adoption and diffusion*. Moreover, the studies consistently show that high Power Distance inhibits adoption, diffusion, and innovation. The area of *IT management and strategy* is more complicated. At this point in the development of this area, there are few general results. Some sources are consistent with Hofstede's PDI research (e.g., Milberg, Burke, Smith and Kallman 1995); and some

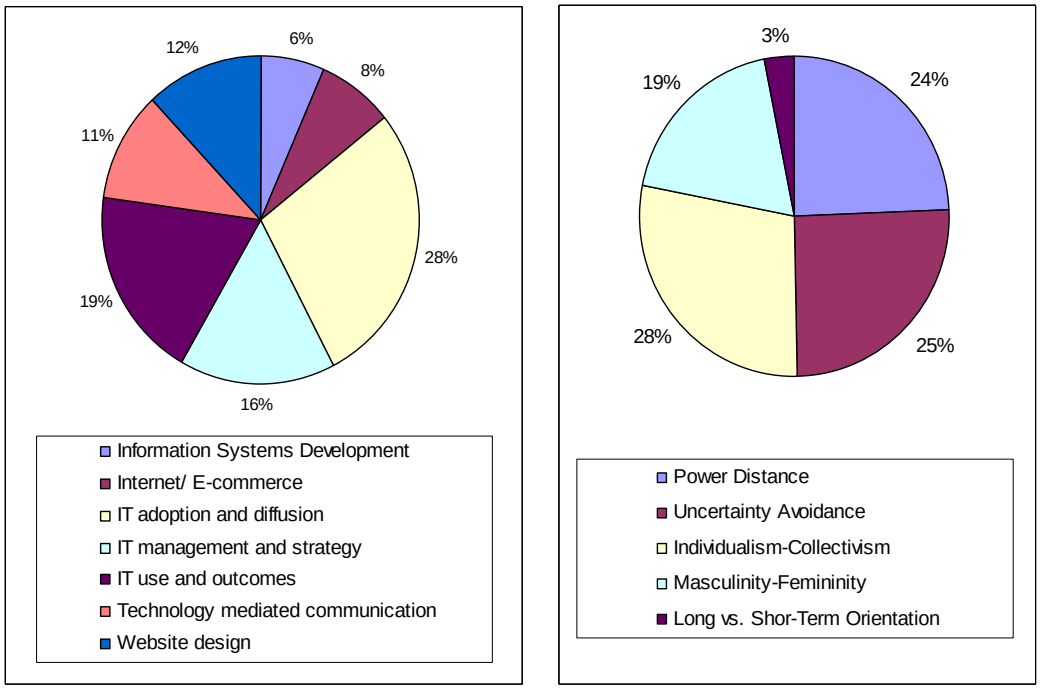


Figure 3. Graphical Summary by Area and Dimension

are not (e.g., Shore, Venkatachalam, Solorzano, Burn, Hassan and Janczewski 2001). Although the results in the area of *IT use and outcomes* are not completely consistent, most studies in this area show that high PDI cultures make better use of IT. This is consistent with Hofstede's work. Hofstede found that high PDI cultures, while more reluctant to adopt IT, expect more from it after adoption than would low PDI cultures. The unique feature of the *technology-mediated communication* area is the use of PDI as dependent variable. Here studies consistently found that technology-mediated communication altered the impact of PDI. The few studies in the *website design* area consistently show that in high PDI cultures, local websites will display more PDI-related features such as formal symmetry, official seals and logos, and provide more detailed explanations.

The Uncertainty Avoidance dimension is also extensively used in IT research. In the *IT adoption and diffusion* area most studies show that high UAI cultures are risk averse and more reluctant to adopt new technology. The area of *IT use and outcomes* has mixed results. According to some studies low UAI cultures are more likely to use technology (e.g., Johns, Smith, and Strand (2003), and prefer to use more efficient forms of technology (Downing, Gallaugher, and Segars (2003). On the other hand, some studies (e.g., Choe 2004; Leidner, Carlsson, Elam and Corrales 1999) found that high UAI cultures had more positive outcomes using technology. This may be due to the fact that, once low UAI cultures become familiar with a given technology, this technology is seen as an uncertainty reducing influence. The few results in the *website design* area are contradictory. Marcus and Gould (2000) showed that high UAI websites display simple, clear imagery and limited choices, while low UAI websites display more complexity of content and choices. This study is consistent with Hofstede's UAI analysis. The remaining two studies (Callahan 2005; Singh, Zhao and Hu 2005) are inconsistent with Hofstede's framework. Results in the *technology-mediated communication* area are consistent with Hofstede's UAI analysis. High UAI cultures displayed Uncertainty Avoidance behavior in relationship to technology-mediated communication.

The most widely used cultural dimension was Individualism-Collectivism, as shown in Table 2. In the *technology adoption and diffusion* area, the generally accepted view is that Collectivism is a barrier to adoption (Lynn and Gelb 1996; Jarvenpaa and Leidner 1998). However, collectivistic cultures will be favorably disposed towards technologies that support or enhance group processes, but not favorably disposed towards technologies that replace face-to-face interactions (Hasan and Ditsa 1999). Although there are as of yet relatively few results in the *systems development* area, several of them make use of the Individualism-Collectivism dimension perhaps because software is typically developed in teams. The *IT management and strategy* area examined a variety of issues including software piracy, IS management, hiring practices, and quality of service. Nonetheless, all results were consistent with Hofstede's definition of Individualism-Collectivism.

The Masculinity-Femininity dimension is not as widely used as the previously discussed cultural dimensions. This may be because this dimension is difficult to understand and easily confused with gender roles and issues. In the *IT adoption and diffusion* area there are but a few studies that rely on this dimension. Nonetheless, these studies seem to indicate that adoption and diffusion is negatively correlated with Masculinity (Van Everdingen and Waarts 2003; Hasan and Ditsa 1999). In the area of *IT use and outcomes* researchers found that Masculinity is an important factor, see Table 2. Similarly, with the exception of one study (Dormann and Chisalita 2002), Masculinity was found to be related to web design elements, see Table 2.

In general, Hofstede dimensions are widely used in IT research to help explain a variety of issues. Results from these studies are sometimes consistent with Hofstede's analysis, but many times they are not. See Table 3. This means Hofstede's framework will explain the impact of culture only to some degree. Culture

is a complicate construct. As Myers and Tan (2002) point out, IS researchers should adopt a more dynamic view of culture. Behavior depends on both the individual and the situation (Hofstede 2001). Hofstede's framework should not be used to predict individual behavior; instead it should be used to understand nuances in how diverse groups view, adopt, and use technology.

Table 4 shows illustrative studies that are inconsistent with Hofstede's framework.

These inconsistencies are perhaps to due to emerging practices, and illustrate that culture needs to be studied at many different levels (Myers and Tan 2002). These inconsistencies highlight the need to extend Hofstede's framework to include more dynamic perspectives of culture as suggested by Myers and Tan (2002) and Jones and Alony (2007).

Representative Studies

Jarvenpaa and Leidner (1998) conducted a single site case study of a Mexican firm through the prism of Hofstede's framework and in particular the Collectivism and the Uncertainty Avoidance dimensions. Mexico is a high Collectivism and a high Uncertainty Avoidance culture. Their study found that certain managerial actions used to develop employee competencies led to the shaping of an organizational culture that was receptive to the IT industry. In turn this new organizational culture led to greater acceptance of company's products.

Hofstede's framework was also applied in technology acceptance studies. For example, Zakour (2003) utilized four dimensions from Hofstede's framework to investigate to what extend national culture influences information technology acceptance. In another example, Dorfman and Howell (1988) first modified Hofstede's framework so that it can be applied at the individual-level. Hwang (2004) then used this modified instrument to determine the impact of Power Distance, Uncertainty Avoidance, and Collectivism on Enterprise Resource Planning (ERP) system adoption at the individual level.

Similarly in the area of IT adoption, Van Everdingen and Waarts (2003) studied the effect of all five cultural dimensions on adoption of ERP systems across ten European countries. The purpose of their study was to investigate why Nordic countries (Denmark, Sweden, Norway) have relatively high adoption rates, while the UK and southern countries like Spain score significantly lower. They found that Hofstede's Uncertainty Avoidance, Masculinity, and the Power Distance indices have significant negative influence on ERP penetration; and that Hofstede's Long-Term Orientation has a significant positive influence on ERP penetration (Van Everdingen and Waarts 2003). Van Everdingen and Waarts (2003) also observed that the effect of Individualism is positive in the early stages of adoption, but that this effect diminishes and may be even changing sign over time. Individualism apparently works in a positive way in getting the diffusion process started and a negative effect at the later stages of the diffusion curve (Van Everdingen and Waarts 2003). Long-

Table3. Consistency of IT Cultural Research with Hofstede's Dimensions

IT-related area	*PDI*	*UAI*	*IDV*	*MAS*	*LTO*
Information Systems Development	Consistent	Consistent	Consistent	Consistent	Unknown
Internet/ e-commerce	Consistent	Consistent	Consistent	Consistent	Unknown
IT adoption and diffusion	Consistent	Consistent	Consistent	Consistent	Unknown
IT management and strategy	*Mixed results*	Mostly consistent	Consistent	Consistent	Unknown
IT use and outcomes	Mostly consistent	*Mixed results*	Mostly consistent	Consistent	Unknown
Technology-mediated communication	Consistent	Consistent	Mostly consistent	Mostly consistent	Unknown
Website design	Consistent	*Mixed results*	*Mixed results*	*Mixed Results*	Unknown

Table 4. Studies Inconsistent with Hofstede's Framework

Source	*Dimension examined*	*IT area*	*Result*	*Why it is inconsistent*
Shore, Venkatachalam, Solorzano, Burn, Hassan and Janczewski (2001)	PDI	IT management and strategy	Students from high PDI culture perceived less of an ethical issue with softlifting (copying software for personal use) than those from low PDI culture.	High PDI culture are generally more respectful of authority and law, thus, it would make more sense if they perceived more of an ethical issue with softlifting.
Choe (2004)	UAI	IT use and outcomes	Under a high level of Advanced Manufacturing Technology (AMT), the positive effect of AMT and information on the improvement of production performance is greater in firms in Korea (high UAI) than in Australia (low UAI).	In general high UAI cultures are less likely to adopt new technologies. This is perhaps because of the inherent risks in new technology adoptions.
Leidner, Carlsson, Elam and Corrales (1999)	UAI	IT use and outcomes	High UAI cultures had more positive outcomes using technology. In particular, Mexican managers perceived faster decision-making speed with EIS use whereas Swedish mangers did not.	In general high UAI cultures are less likely to adopt new technologies. This is perhaps because of the inherent risks in new technology adoptions.
Callahan (2005)	UAI, IDV	Web Design	Analyzed university home pages from Malaysia, Austria, US, Ecuador, Japan, Sweden, Greece and Denmark on the basis of two criteria: organization and graphical design. Correlated element frequency scores with Hofstede's indices and concluded that correlations between Hofstede's scores and frequency counts of interface elements were weaker than anticipated. Suggested that there could be three possible explanations for the weak correlations: (1) Hofstede's model may not be valid, as some of its critics suggest; (2) Hofstede's model may be valid but the cultural markers associated with each or some of the dimensions are based on faulty assumptions; or (3) Hofstede's model is not applicable to the study of graphical representations.	One would expect elements of local website to reflect local values. Other studies found that website elements correlate with Hofstede's dimensions.
Singh, Zhao and Hu (2005)	UAI	Web Design	Study did not confirm that local Japanese websites will depict highest level of uncertainty reducing features. India had the highest level of uncertainty reducing features.	One would expect elements of local website to reflect local values. Other studies found that website elements correlate with Hofstede's dimensions.
Dormann and Chisalita (2002)	MAS	Web Design	Found a limited correlation between the MAS index and masculine and feminine values presented on the sites.	One would expect elements of local website to reflect local values. Other studies found that website elements correlate with Hofstede's dimensions.

Term Orientation is a relatively recent addition to Hofstede's cultural framework; and Van Everdingen and Waarts study is one of the first instances of an application of the Long-Term Orientation index to IT research.

Yeniyurt and Townsend (2003) investigated the role of cultural differences in the acceptance of new IT products, as moderated by socio-economic variables. They utilized Hofstede's cultural dimensions, along with secondary data representing socio-economic structure and the penetration rate of new IT products. The penetration of new IT products was measured by the Internet usage, PC ownership, and cellular phone ownership. The results demonstrated that Hofstede's Power Distance and Uncertainty Avoidance have a negative effect on the acceptance of new IT products; that Individualism has a positive effect on the acceptance of new IT products; and that Masculinity has no significant on the acceptance of new IT products. Yeniyurt and Townsend did not report any finding regarding Hofstede's Long-Term Orientation index.

In a similar study Yaveroglu and Donthu (2002) examined cultural influences on the diffusion of new products using data from 19 countries. They used Hofstede's Power Distance, Uncertainty Avoidance, and Individualism dimensions. IT products used to calculate innovation and imitation values included VCRs, cellular phones, home computers, TVs, and other consumer electronic products. The results of their study indicated that the coefficient of innovation is high in countries that are high on Individualism, low on Uncertainty Avoidance, and low on Power Distance; and that the coefficient of imitation is high in countries that are low on Individualism and high on Uncertainty Avoidance. Like most studies in this area, Yaverogly and Donthu did not report any finding regarding Hofstede's Long-Term Orientation and Masculinity dimensions.

The study of Dwyer, Mesak, and Hsu (2005) investigated the relationship between national culture and the cross-national diffusion of technological innovations between 13 European countries. Dwyer, Mesak, and Hsu (2005) found support linking four cultural dimensions - Individualism, Masculinity, Power Distance, and Long-Term Orientation - to cross-national product diffusion. The findings suggest that national culture explains a relatively sizable amount of variation in cross-national diffusion rates (Dwyer, Mesak, and Hsu 2005).

The study of Lynn and Gelb (1996) focused on Individualism and Uncertainty Avoidance combined with purchasing power as predictors of levels of national innovativeness with technological consumer products. Lynn and Gelb (1996) selected seven indicators of national innovativeness - the percentage of households in a nation owning a cordless telephone, a telephone answering machine, a home computer, a microwave, a compact disc player, a video camera and a satellite dish. The study concluded that national innovativeness is related to national levels of Individualism, Uncertainty Avoidance, and purchasing power.

Lippert and Volkmar (2007) used Masculinity dimension to study post adoption attitudes and behaviors of US and Canadian users classified by nationality and gender. They called attention to the fact that conventional considerations usually consider US and Canada a unitary homogenized cultural unit; however, the difference in the Masculinity index for these two countries is statistically significant. Lippert and Volkmar (2007) argue that this difference can have an important effect on workplace attitudes and behaviors with respect to technology acceptance and utilization. The study reinforced the importance of value differences related to Hofstede's Masculinity dimension in shaping gender expectations and attitudes. Their study also found that grouping by country may be inadequate and that a consideration of both country and gender may be more insightful (Lippert and Volkmar, 2007). In particular, they found that American women and Canadian men and women have similar expectations and attitudes toward IT utilization while American men have a distinct mindset.

Kankanhalli, Tan, Wei and Holmes (2004) examined the relationship between the cultural background and values of IS developers. They compared IS developers in

Singapore and the US by using dimensions of Individualism-Collectivism and Masculinity-Femininity. The three values examined in their study were technical, economic, and socio-political. The results of this study reports that IS developers from the US, a high Individualism and high Masculinity country, have stronger economic, technical, and socio-political values than IS developers from Singapore, a low Individualism and low Masculinity country (Kankanhalli, Tan, Wei and Holmes 2004).

Hofstede's theory of culture was also applied by Barnett and Sung (2005) to determine the relationship between the cultural dimensions and Internet hyperlink network centrality. Barnett and Sung (2005) used algorithms to calculate the number of links from the websites of certain countries to different countries and examined the pattern of directional hyperlinks of more than 356 million links. They found that only Individualism is significantly related to the centrality of hyperlink networks; other relationships between Hofstede's dimensions and network centrality were not significant.

An exploratory study by Gefen and Heart (2006) examined whether definitions of trust beliefs as conceptualized and verified in the US apply in Israel and how this may impact e-commerce success. Because Israel significantly differs from the US in Individualism, Uncertainty Avoidance, and Power Distance, Gefen and Heart (2006) hypothesized that national culture has effect on trust beliefs in e-commerce environment. Gefen and Heart's (2006) analysis shows that trust may work differently in different countries. They point out that trust is dependent on two factors: reducing social uncertainty and willingness to depend on others. Since these two factors are captured by Hofstede's Individualism, Power Distance, and Uncertainty Avoidance dimensions, Hofstede's framework should help explain trust mechanisms in an e-commerce environment (Gefen and Heart 2006). Their study does not report on the impact of the two other dimensions in Hofstede's framework, the Masculinity-Femininity and the Long-Term Orientation dimensions.

Gong, Li and Stump (2007) investigated the effect of national culture on Internet use and in addition whether this effect is moderated by socio-economic factors, such as levels of education. They found that nearly all of Hofstede's cultural dimensions impacted Internet penetration either as main effects or as interactions with the country's educational levels. Specifically, the Power Distance and the Masculinity-Femininity dimensions negatively impact Internet diffusion while the Long-Term Orientation bolsters it.

Hermeking (2005) maintained that Hofstede's cultural model is a national construct and makes sense only in inter-country comparisons; not in intra-country cultural comparisons. According to Hermeking (2005), if several individuals increasingly use the Internet to observe and imitate a new lifestyle from abroad as a kind of resistance against their dominant culture, Hofstede's framework in research of Internet usage may not work. Hermeking (2005) found that Internet usage has strong positive correlation with Hofstede's Individualism dimension and a strong negative correlation with Hofstede's Uncertainty Avoidance dimension.

Lim (2004) examined the role of Hofstede's Power Distance dimension in online bargaining. This study was designed as a laboratory experiment and included users from Singapore representing high PDI culture and users from Mauritius representing low PDI culture. The main research purpose was to determine the effect of explanation facility on negotiation outcomes. Another research purpose was to find out how PDI moderates the relationship between the explanation facility and the negotiation outcome. Lim (2004) concluded that PDI was the moderator. Particularly, the benefits of explanation facility are visible in high Power Distance contexts, but non-existent in low Power Distance contexts.

An and Kim (2007) used Hofstede's dimension of Masculinity-Femininity to study differences in gender role portrayals in Web ads in Korea and the US. An and Kim (2007) surveyed different themes and roles portrayed by women and men in 400 Web ads and concluded that greater percentage of Korean

ads featured characters in relationship themes, featured women as a main character, and portrayed them in family and recreational roles. Their study showed that Hofstede's framework can be used to determine appropriate Web-based advertising based on gender roles pertinent to a specific culture.

In a study of global Web user interface design Marcus and Gould (2000) used Hofstede's cultural dimensions to study how culture affects Web design. They sampled a number of websites in different cultures and concluded that there is enough statistical regularity to identify trends and tendencies consistent with Hofstede's framework. Marcus and Gould (2000) asserted that these trends and tendencies should not be treated as deviances, but recognized as differing patterns of values and thought.

Hornik and Tupchiy (2006) used four different patterns of Individualism and Collectivism: Horizontal Collectivist, Horizontal Individualist, Vertical Collectivist, and Vertical Individualist. Their study hypothesized that these patterns are associated with the use of technology-mediated learning and individuals' learning outcomes. As predicted, the cultural patterns affected the learning outcomes in a technology-mediated learning environment, although not uniformly (Hornik and Tupchiy 2006).

Hewling (2005) used both Hofstede's and Hall's theories to look at discussion board messages from two online classes. The classes in the study were based in an Australian university and recruited both Australian and non-Australian students. Some of the students were physically located in Australia. The other students lived elsewhere around the world, including North America, South East Asia, the Middle East, and Europe. The research consisted of a series of messages exchanged in an online classroom. Each message was interpreted. The inference was drawn based on the country of origin of the person posting the message. For example, from the welcome message one Sudanese student posted to the class when he first came online, Hewling (2005) established that he is from the Arab north of the country and is currently working in the Gulf. Hewling (2005) then refers to Hofstede (2001) who described "The Arab World" as high Power Distance and high Uncertainty Avoidance. Hewling (2005) predicts that this particular student might expect to find the class a highly structured and controlled environment where rules will minimize uncertainty, and status will control how much of a voice he has (Hewling 2005). In addition, because this student came from the low Individualism culture, according to Hofstede (2001), Hewiling (2005) wonders if this is a cause for speculation as to whether or not he feels a part of the group that is the class.

Similarly, Hewling (2005) examined a message exchange among five students, three Canadian, one American, and one Australian, noting that in terms of Hofstede's analysis, these participants come from national backgrounds that share many commonalities. In this case, one might expect that these students will have similar ideas and perceptions, and because all of them came from high IDV countries they will express their thoughts in a direct and straightforward manner (Hewing 2005). This does happen at some points, but cannot be considered as occurring universally, Hewing (2005) noted. Overall, Hewing (2005) concluded that on its own, nationality is not entirely an effective predictor of behavior or understanding and Hofstede's analysis fails to capture the intricate nuances of online communication among students from different cultural backgrounds.

The study of Kersten, Koeszegi and Vetschera (2003) examined direct and indirect effects of culture on IT-mediated negotiations and took Hofstede's cultural dimensions into account in a cultural analysis conducted in the study. Participants were MBA or graduate students who were asked to conduct negotiations as a part of the course work requirements. Kersten, Koeszegi and Vetschera (2003) used the national culture as an independent variable and restricted their sample to participants for whom both the country of birth and the country of residence was the same. Their results confirmed that culture had a significant effect on most dependent variables at an aggregate level. Only one variable, the probability of agreement, showed no impact of culture at all (Kersten, Koeszegi and Vetschera 2003).

Lim and Yang (2007) examined the impact of Negotiation Support System (NSS) on the different phases of negotiation. The results of their study demonstrated that both pre-negotiation and negotiation support improved gains in outcome with increased time in reaching agreement and show the usefulness of NSS in enhancing the quality of differing stages of negotiation. Their research also recognized the important role of culture in the negotiation setting. In particular, they suggested that UAI impacts how people view and use pre-negotiating support tool. Because environment becomes less ambiguous as the pre-negotiation support has facilitated the negotiators to specify issues and weightings, prior to the actual negotiation, it is possible that negotiators from a higher UAI culture will spend more time and effort in the preparation process with the help of pre-negotiation support tool since they might have developed a lower limit for risk perception (Lim and Yang 2007).

Tung and Quaddus (2002) conducted two studies of Group Support Systems (GSS): one in Singapore, and another in Australia. In particular, Tung and Quaddus (2002) examined the impact of Decision Conferencing type of GSS on group conflict and conflict management from the cultural perspective. In their study they used Hofstede's dimensions to evaluate the effect of culture on GSS use. According to Tung and Quaddus (2002), the low PDI in Australia indicates that individuals feel on equal footing and feel comfortable with airing their views without any fear of being judged. Tung and Quaddus (2002) stressed that this may explain why Singaporean group exhibited higher avoidance behavior as compared to the Australian group. Singaporean group also exhibited a high need for consensus. Tung and Quaddus (2002) explained this phenomenon by identifying Singapore as a low UAI culture. Their study also showed that the productivity gains are higher for high PDI cultures (Tung and Quaddus 2002).

Finally, Husted (2000) conducted an archival data analysis of 39 different countries and concluded that software piracy is less prevalent in Individualistic (as compared to Collectivistic) cultural settings.

Additional examples of studies that used Hofstede's theory of culture in IT-related research can be found in Appendix D.

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

This literature review focused on the application of national culture theories to IT research and found that although there are several cultural frameworks, Hofstede's is by far the most widely used. Hofstede's framework has consistently helped explain the complexities of the impact national culture has on the various areas of IT research. We carried out an exhaustive review of Hofstede-based IT research. In carrying out a quantitative analysis and a qualitative analysis this review makes four contributions. First, we identified several opportunities for Hofstede-based IT research.

- The absence of studies using Long-Term Orientation is the most notable gap. LTO may influence, for example, *IT use and outcomes* as well as *IT adoption and diffusion*. Yet there are no LTO studies in these areas.
- Most studies using Masculinity-Femininity are exploratory; yet this dimension appears to be a strong factor driving IT development, adoption, and use. This suggests that there is a need for Masculinity-based empirical research.
- Compared to other research areas, *Internet/e-commerce* and *software development* are lagging behind. Although one can explain this gap with respect to the *Internet/e-commerce* area, it is troubling that so little is know about the impact of national culture on software development given the surge in outsourcing and international development teams.

Second, our review of this literature suggests that there are opportunities to use other cultural frameworks. For example, Hall's dimension of "high-context" versus "low-context" seems to be a good fit for research in the *technology-mediated communication* area. In addition, Schwartz's SVI is separated into an individual-level and a culture-level analysis, which makes the SVI framework applicable to

both the group and the individual level. In comparison, Hofstede's framework is only applicable at the group level. For all these reasons, among others, the other cultural frameworks may be used to advantage in IT research.

Third, this review showed that not all results can be explained by Hofstede's value-based perspective and perhaps local customs and practices which many tend to associate with culture have an impact. As Myers and Tan (2002) accurately point out, despite the popularity of the Hofstede framework, his representation of culture does not take into account a variety of other important international national, regional, business, and organizational factors. Because these factors are often inter-connected and intertwined, they appropriately recommend to study culture at many different levels of analysis. Thus, another area of future research is to extend the existing results to include the dynamic perspectives offered by Myers and Tan (2002) and Jones and Alony (2007).

Forth and last, this review confirms that Hofstede's theory is an excellent tool for business. Hofstede's value-based cultural dimensions help identify both differences and similarities between cultures. This review shows that these national traits can either enable or inhibit IT success. Understanding these enables and inhibitors can be used for the purpose of implementing effective IT applications – applications that account for and take advantage of the emerging trend towards heterogeneous groups working, learning, and living together in an increasingly global and virtual world. The heterogeneous nature of global work teams can yield a formidable creative force that can be a source of competitive advantage if properly harnessed. Individuals from various cultural groups have a lot to offer. The emerging globalization of society in general and business in particular will be successful only if we learn to work, live, and study well together in this environment. By understanding the needs and expectations of each group, as illustrated by Hofstede's cultural theory we may be able to develop technologies that will better serve businesses and communities.

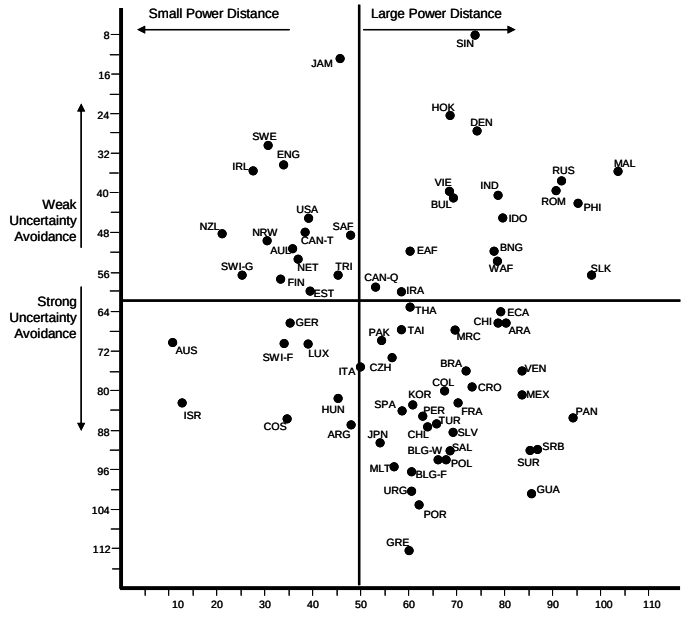
APPENDIX A - CULTURAL DIMENSIONS INDEX VALUES

Country	*PDI*	*IDV*	*UAI*	*MAS*	*LTO*
Arab Countries	80	38	68	53	-
Argentina	49	46	86	56	-
Australia	36	90	51	61	31
Austria	11	55	70	79	31
Bangladesh	80	20	55	55	40
Belgium (Flemish)	61	78	97	43	-
Belgium (Walloon)	67	72	93	60	-
Brazil	69	38	76	49	65
Bulgaria	70	30	40	40	-
Canada (Quebec)	54	73	60	45	30
Canada (Total)	39	80	48	52	23
Chile	63	23	86	28	-
China	80	20	66	66	118
Colombia	67	13	80	64	-
Costa Rica	35	15	86	21	-
Croatia	73	33	80	40	-
Czech Republic	57	58	74	57	13
Denmark	74	74	23	16	46
East Africa	64	27	52	41	-
Ecuador	78	8	67	63	-
El Salvador	66	19	94	40	-
England	35	89	35	66	25
Estonia	40	60	60	30	

Country	*PDI*	*IDV*	*UAI*	*MAS*	*LTO*
Finland	33	63	59	26	41
France	68	71	86	43	39
Germany	35	67	65	66	31
Greece	60	35	112	57	-
Guatemala	95	6	101	37	-
Hong Kong	68	25	29	57	96
Hungary	46	80	82	88	50
India	77	48	40	56	61
Indonesia	78	14	48	46	-
Iran	58	41	59	43	-
Ireland	28	70	35	68	43
Israel	13	54	81	47	-
Italy	50	76	75	70	34
Jamaica	45	39	13	68	-
Japan	54	46	92	95	80
Korea (South)	60	18	85	39	75
Luxembourg	40	60	70	50	-
Malaysia	104	26	36	50	-
Malta	56	59	96	47	-
Mexico	81	30	82	69	-
Morocco	70	46	68	53	-
Netherlands	38	80	53	14	46
New Zealand	22	79	49	58	30
Nigeria	-	-	-	-	16
Norway	31	69	50	8	-
Pakistan	55	14	70	50	0
Panama	95	11	86	44	-
Peru	64	16	87	42	-
Philippines	94	32	44	64	19
Poland	68	60	93	64	32
Portugal	63	27	104	31	30
Romania	90	30	42	42	-
Russia	93	39	36	36	-
Serbia	86	25	92	43	-
Singapore	74	20	8	48	48
Slovakia	104	52	51	110	38
Slovenia	71	27	88	19	-
South Africa	49	65	49	66	-
Spain	57	51	86	42	19
Suriname	85	47	92	37	-
Sweden	31	71	29	5	33
Switzerland (Total)	-	-	-	-	40
Switzerland (French)	34	68	70	58	40
Switzerland (German)	26	69	56	72	-
Taiwan	58	17	69	45	87
Thailand	64	20	64	34	56
Trinidad	47	16	58	58	-
Turkey	66	37	86	45	-
Uruguay	61	36	100	38	-
US	40	91	46	62	29
Venezuela	81	12	76	73	-
Vietnam	70	20	40	40	80
West Africa	77	20	54	46	-
Zimbabwe	-	-	-	-	25

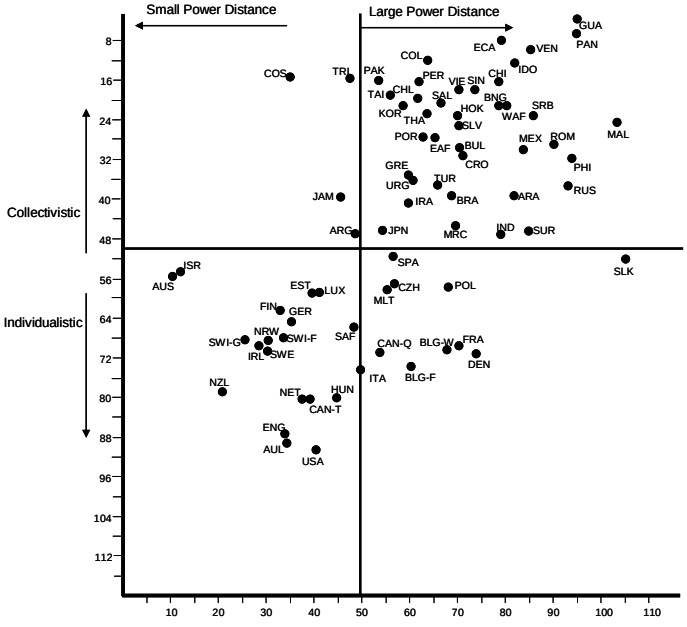
Source: Hofstede (2001); Hofstede and Hofstede (2005)

APPENDIX B - PDI-UAI AXIS



Adapted from Hofstede (2001); Hofstede and Hofstede (2005)

APPENDIX C - PDI-IDV AXIS



Adapted from Hofstede (2001); Hofstede and Hofstede (2005)

APPENDIX D - EXISTING LITERATURE IN THE IT-RELATED AREAS USING HOFSTEDE'S THEORY OF CULTURE

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
An and Kim (2007)	Internet/ E-commerce	Korea and US	Quantitative content analysis				Consistent with Hofstede's framework, greater percentage of Korean ads featured characters in relationship themes, featured women as a main character, and portrayed them in family and recreational roles.	
Barnett and Sung (2005)	Internet/ E-commerce	Multiple countries	Analysis of hyperlink patterns			Only Individualism is significantly related to the centrality of hyperlink networks; other relationships between Hofstede's dimensions and network centrality were not significant.		
Burn, Saxema, Ma, and Cheung (1993)	IT management and strategy	Hong Kong	Delpi study of 98 senior IT managers	Cultural values may influence the types of IS issues perceived to be more critical by IS managers.	Cultural values may influence the types of IS issues perceived to be more critical by IS managers.	Cultural values may influence the types of IS issues perceived to be more critical by IS managers.	Cultural values may influence the types of IS issues perceived to be more critical by IS managers.	

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Callahan (2005)	Website design	Malaysia, Austria, US, Ecuador, Japan, Greece, Sweden, & Denmark	Content analysis of website graphical elements	The presence of logos was positively correlated with the PDI: the high PDI countries had significantly higher frequency of logos than low PDI countries.	Contrary to the Hypothesis graphical elements did not show significant correlation with UAI dimension.	Contrary to the Hypothesis graphical elements did not show significant correlation with IDV dimension.	Images of people were negatively correlated with the MAS index, thus home pages in feminine countries would more often show images of people than pages in high MAS countries. Countries with a high MAS index had more images of buildings.	
Choe (2004)	IT use and outcomes	Korea and Australia	Survey of firms	Under a high level of AMT, the positive effect of AMT and information on the improvement of production performance is greater in Korean than Australian firms.	Under a high level of AMT, the positive effect of AMT and information on the improvement of production performance is greater in Korean than Australian firms.	Under a high level of AMT, the positive effect of AMT and information on the improvement of production performance is greater in Korean than Australian firms.		
Chung and Adams (1997)	IT use and outcomes	US and Korea	Comparative survey	Respondents from Korea and US had no significant differences in group decision making behaviors attributable to Hofstede's dimensions.	Respondents from Korea and US had no significant differences in group decision making behaviors attributable to Hofstede's dimensions.	Respondents from Korea and US had no significant differences in group decision making behaviors attributable to Hofstede's dimensions.	Respondents from Korea and US had no significant differences in group decision making behaviors attributable to Hofstede's dimensions.	

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Dormann and Chisalita (2002)	Website design	5 different countries	Surveyed participants evaluating websites				Found a limited correlation between the MAS index and masculine and feminine values presented on the sites.	
Downing, Gallaugher, and Segars (2003)	IT use and outcomes	Japan and US	Interpretive field study		Japanese companies (high UAI) tend to select more information rich, socially present forms of media to facilitate empowerment, whereas US companies (low UAI) tend to select more lean (efficient) forms of electronic media.	Japanese companies (Collectivistic) tend to select more information rich, socially present forms of media to facilitate empowerment, whereas US companies (Individualistic) tend to select more lean (efficient) forms of electronic media.		
Dwyer, Mesak, and Hsu (2005)	IT adoption and diffusion	13 European countries	Exploratory study	National culture explains a relatively sizable amount of variation in cross-national diffusion rates of technological innovations.		National culture explains a relatively sizable amount of variation in cross-national diffusion rates of technological innovations.	National culture explains a relatively sizable amount of variation in cross-national diffusion rates of technological innovations.	National culture explains a relatively sizable amount of variation in cross-national diffusion rates of tech. innovations

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Garfield and Watson (1998)	IT adoption and diffusion	7 different countries	Descriptive case study	Countries will follow similar NII development models (family, village market, pyramid of people, or well-oiled machine) based upon similar cultural values related to PDI.	Countries will follow similar NII development models (family, village market, pyramid of people, or well-oiled machine) based upon similar cultural values related to UAI.			
Gefen and Heart (2006)	Internet/ E-commerce	US and Israel	Exploratory study	Hofstede's dimensions should affect trust in e-commerce environment.	Hofstede's dimensions should affect trust in e-commerce environment.	Hofstede's dimensions should affect trust in e-commerce environment.		
Gong, Li and Stump (2007)	Internet/ E-commerce	58 different countries	Empirical research	Power Distance of a culture hinders Internet diffusion.			Masculinity of a culture slows down the Internet adoption.	Long-Term Orientation bolsters Internet diffusion.
Griffith (1998)	IT adoption and diffusion	US and Bulgaria	Laboratory experiment	Bulgarian students (low PDI) were more likely to report being dissatisfied with the GSS outcome than were US students.				

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Hasan and Ditsa (1999)	IT adoption and diffusion	10 organizations in Middle East, Africa, and Australia	Interpretive field study	Successful adoption of IT is more likely where IT staff are able to give advice to IT manage (low PDI).	IT is less readily adopted in risk-averse cultures (high UAI), since technology is perceived as inherently risky.	Adoption of group-oriented IT (e.g., GSS) is more favorably disposed to Collectivistic vs. Individualistic cultures.	Patterns of IT adoption may vary according to level of Masculinity (technology focus) vs. Femininity (focus on people and end-users) of culture.	
Hermeking (2005)	Internet/ E-commerce	Multiple countries	Qualitative long-term research		Found a strong negative correlation between high Uncertainty Avoidance and Internet usage.	Found a strong positive correlation between high Individualism and Internet usage.		
Hewling (2005)	Technology mediated communication	Australian and non-Australian students from online university	Online message analysis	The inference was drawn based on the country of origin of the person posting the message. For example, predicts that a particular student from high PDI culture find the class a highly structured and controlled environment where status will control how much of a voice he has.	The inference was drawn based on the country of origin of the person posting the message. For example, predicts that a particular student from high UAI culture find the class a highly structured and controlled environment where rules will minimize uncertainty.	The inference was drawn based on the country of origin of the person posting the message. For example, wonders if a particular student from low IDV culture feels a part of the group in the class.		

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Hornik and Tupchiy (2006)	Technology mediated communication	US	Empirical research			Different patterns used in the study - Horizontal Collectivist, Horizontal Individualist, Vertical Collectivist, and Vertical Individualist - are associated with the use of TML and individuals' learning outcomes.		
Hunter and Beck (2000)	Information Systems development	Canada and Singapore	Field study interviews	Differences found across cultures in how excellent system analysts are perceived.	Excellent analysts from Singapore (low UAI) are perceived to follow a more technocratic, dominant approach to clients, while Canadian analysts (moderate-low UAI) follow a more participative approach.	Singaporean excellent analysts (high Collectivism) are perceived to follow a more technocratic, dominant approach to clients, while Canadian analysts (high Individualism) follow a more participative approach.	Differences found across cultures in how excellent system analysts are perceived.	
Husted (2000)	IT management and strategy	39 different countries	Archival data analysis			Software piracy is less prevalent in Individualistic (as compared to Collectivistic) cultural settings.		

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Jarvenpaa and Leidner (1998)	IT adoption and diffusion	Mexico	Single site case study		Mexican IS company succeeded despite high UAI, seen as cultural barrier. Managerial actions led to greater acceptance of company's products.	Mexican IS company succeeded despite high Collectivism, seen as cultural barrier. Managerial actions led to greater acceptance of company's products.		
Johns, Smith, and Strand (1983)	IT use and outcomes	78 multinational corporations (MNC)	Survey of corporations		MNCs with lower UAI are more likely to embrace new technologies and to encounter fewer impediments to international data flow.			
Kankanhalli, Tan, Wei and Holmes (2004)	Information Systems development	US and Singapore	Survey of 10 large organizations in each country			IS developers with individualistic inclination appear to have stronger economic, technical, and socio-political values than IS developers with collectivistic inclination.	IS developers with masculine inclination seem to have stronger economic, technical, and socio-political values than IS developers with feminine inclination.	

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Keil, Tan, Wei, Saarinen, Tuunainen, and Wassenaar (2000)	Information Systems development	Finland, Singapore, Netherlands	Matching lab experiments		Cultures low in UAI (Singapore) exhibited greater tendencies to continue with troubled IT projects since their perceived risk was lower than with high UAI cultures.			
Kersten, Koeszegi and Vetschera (2003)	Technology mediated communication	Australia, Canada, US, Germany, Ecuador, Taiwan, Finland, India, Russia & HK	Empirical analysis	Culture had a significant effect on most dependent variables at an aggregate level. Because communication technology reduces the transmission of social cues, cultural dimensions, such as PDI, are reduced in their impact.				
Kettinger, Lee, and Lee (1995)	IT management and strategy	US, Korea, Hong Kong, & Netherlands	Survey of IS users	Service quality of IS function differs across national cultures.	Service quality of IS function differs across national cultures.	Service quality of IS function differs across national cultures.	Service quality of IS function differs across national cultures.	

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Leidner, Carlsson, Elam, Corrales (1999)	IT use and outcomes	Sweden and Mexico	Survey of senior managers	Mexican mangers perceived faster decision-making speed with EIS use whereas Swedish mangers did not. Suggested that EIS may be best suited in countries with low to moderate PDI.	Mexican managers perceived faster decision-making speed with EIS use whereas Swedish mangers did not. Suggested that EIS may be best suited in countries with low to moderate UAI.	Found significant differences (as predicted by national cultural factors) in the impact of EIS.	Found significant differences (as predicted by national cultural factors) in the impact of EIS.	
Lim (2004)	Internet/ E-commerce	Singapore and Mauritius	A laboratory experiment	The benefits of explanation facility were visible in high PDI context, but non-existent in low PDI context.				
Lim and Yang (2007)	Technology mediated communication	Singapore	A laboratory experiment		UAI impacts how people view and use pre-negotiating support tool.			
Lippert and Volkmar (2007)	IT use and outcomes	US and Canada	Empirical research				The study reinforced the importance of value differences related to the MAS dimension in shaping gender expectations and attitudes.	
Lynn and Gelb (1996)	IT adoption and diffusion	16 European countries	Empirical research		National innovativeness is related to national levels of UAI.	National innovativeness is related to national levels of IDV.		

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Marcus and Gould (2000)	Website design	Costa Rica and US	Analysis of 2 university websites, 2 national park websites, 2 women's websites, and 2 airlines websites from contrasting cultures.	Consistent with Hofstede's framework Malaysian website (high PDI) features strong axial symmetry, official seal, faculty photographs, and provides detailed explanations. Dutch website (low PDI) emphasizes students as equals.	Consistent with Hofstede's framework the website from Belgium (high UAI) shows simple, clear imagery and limited choices. British website shows more complexity of content and choices (low UAI).	Consistent with Hofstede's framework the US website (high IDV) features an emphasis on the visitor, his/her goals, and possible actions in coming to the park. The Costa Rican Website (Collectivistic) features an emphasis on nature and downplays the individual tourist.	Consistent with Hofstede's framework Japanese Woman.Excite website (high MAS) narrowly orients its search portal toward a specific gender, which this company does not do in other countries. The website from Sweden (low MAS) makes no distinction in gender or age.	Consistent with Hofstede's framework, German website (low LTO) shows a typical Western corporate layout emphasizing crisp, clean functional design aimed at achieving goals quickly. The Chinese version requires more patience to achieve navigational and functional goals.
Mejias, Shepherd, Vogel, and Lazaneo (1997)	IT use and outcomes	US and Mexico	Matching lab experiments	In GSS supported environments Mexican teams (high PDI) experienced higher levels of group consensus, satisfaction, and participation equity than their US counterparts.	In GSS supported environments Mexican teams experienced higher levels of group consensus, satisfaction, and participation equity than their US counterparts with main effects due to national culture and experimental treatment.	In GSS supported environments Mexican teams (low IDV) experienced higher levels of group consensus, satisfaction, and participation equity than their US counterparts.	In GSS supported environments Mexican teams experienced higher levels of group consensus, satisfaction, and participation equity than their US counterparts with main effects dues to national culture and experimental treatment.	

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Milberg, Burke, Smith, and Kallman (1995)	IT management and strategy	30 different countries	Survey of 900 audit and control respondents	Countries exhibiting higher levels of PDI exhibited higher levels of government involvement in privacy regulation.	Countries exhibiting higher levels of UAI exhibited higher levels of government involvement in privacy regulation.	Countries exhibiting higher levels of IDV exhibited lower levels of government involvement in privacy regulation.		
Png, Tan, and Wee (2001)	IT adoption and diffusion	23 different countries	Multinational survey of 153 businesses	PDI was not significantly correlated with adoption of frame relay technology.	Businesses form higher UAI countries were less likely to adopt IT infrastructure (frame relay).			
Quaddus and Tung (2002)	IT use and outcomes	Australia and Singapore	Matching lab experiments			Australian groups (high IDV) tended to generate more conflict than Singaporean groups.	Australian groups (high MAS) tended to generate more conflict than Singaporean groups.	
Shore, Venkatachalam, Solorzano, Burn, Hassan, and Janczewski (2001)	IT management and strategy	New Zealand, Hong Kong, Pakistan, and US	Survey of students	Students from high PDI cultures perceived less of an ethical issue with softlifting (copying software for personal use).	Students from high UAI cultures perceived less of an ethical problem with software piracy.	Students from Individualistic cultures perceived more of an ethical problem with software piracy.	Students from MAS cultures perceived more of an ethical problem with software piracy.	

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Singh, Zhao, and Hu (2005)	Website design	China, India, Japan, and US	Qualitative/ quantitative research, content analysis	Found that local Chinese and Indian websites will depict highest levels of Power Distance oriented features, followed by local Japanese and US websites.	Study did not confirm that local Japanese websites will depict highest level of uncertainty reducing features. India had the highest level of uncertainty reducing features.	Japanese and Chinese websites were significantly higher in the depiction of the Collectivistic values compared to the US & Indian websites. US websites showed the highest levels of IDV oriented features, followed by India, Japan, and China.	Found that local Japanese websites show the highest levels of Masculinity oriented features, followed by US, India, and China.	
Slaughter and Ang (1995)	IT management and strategy	US and Singapore	Longitudinal content analysis			Cultural norms (Collectivist, loyalty, family orientation) in Singapore favor internal IS employment structures while US culture (high IDV) favors more externalized IS employment structures.		
Srite (2000)	IT adoption and diffusion	33 different countries	Field study of foreign students	Individuals from high PDI countries were found to be less innovative and less trusting of technology.				

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Steensma, Marino, Weaver, and Dickson (2000)	IT management and strategy	5 different countries	Five country survey of SMEs		The tendency for SMEs to form technology alliances with others is greatest in countries that rate high in Uncertainty Avoidance.	SMEs in countries with Collectivistic values (Indonesia, Mexico) are more likely to form technology alliances involving equity ties than SMEs in more Individualistic countries (Australia).	The tendency for SMEs to form technology alliances with others is greatest in countries that rate high in Femininity.	
Straub, Keil, and Brenner (1997)	IT management and strategy	US, Japan, and Switzerland	Survey of airline employees	TAM holds for both US and Switzerland, but not for Japan (high PDI). Suggests that TAM may not be universally applicable across cultures.	TAM holds for both US and Switzerland, but not for Japan (high UAI). Suggests that TAM may not be universally applicable across cultures.	TAM holds for both US and Switzerland, but not for Japan (Collectivistic). Suggests that TAM may not be universally applicable across cultures.	TAM holds for both US and Switzerland, but not for Japan (higher MAS). Suggests that TAM may not be universally applicable across cultures.	
Tan, Smith, and Keil (2003)	Information Systems development	Singapore and US	Matching lab experiment			Individualistic cultures amplify the impact of organizational climate on predisposition to report bad news, whereas Collectivism strengthens the impact of information asymmetry on predisposition to report bad news.		

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Tan, Wei, Watson, and Walczuch (1998)	Technology mediated communication	US and Singapore	Matching lab experiments	CMC may be more helpful in reducing negative status influence affects in high PDI cultures.		CMC may be more helpful in reducing negative status influence affects in Collectivistic cultures.		
Tan, Wei, Watson, Clapper, and McLean (1998)	Technology mediated communication	US and Singapore	Matching lab experiments			In Individualistic cultures (US) majority influence was stronger in the unsupported setting than in CMC setting. There were no corresponding differences in the Collectivistic culture (Singapore).		
Thatcher, Srite, Stepina, and Liu (2003)	IT adoption and diffusion	US	Survey of US college students	Individuals high in PDI may be less wiling to innovate or experiment with IT.	Individuals high in UAI may be less wiling to innovate or experiment with IT.			
Tung and Quaddus (2002)	Technology mediated communication	Australia and Singapore	Comparative study, lab experiments	Low PDI in Australia indicates that individuals feel on equal footing and feel comfortable with airing their views without any fear of being judged. Showed that productivity gains are higher for high PDI cultures.	Singaporean group (low UAI) exhibited higher avoidance behavior as compared to the Australian group. Singaporean group also exhibited a high need for consensus.	Singaporean group (Collectivistic) reported lower levels of conflict compared to Australian group.	Singaporean group reported lower levels of interpersonal conflict as compared to the Australian group.	

Source	*IT-related area*	*Countries/ cultures*	*Methodology*	*PDI findings*	*UAI findings*	*IDV findings*	*MAS findings*	*LTO findings*
Van Everdingen and Waarts (2003)	IT adoption and diffusion	10 European countries	Empirical research	Found a significant negative influence of the Power Distance index on ERP penetration.	Found a significant negative influence of the UAI index on ERP penetration.	The effect of Individualism is positive in the early stage of ERP adoption, but the effect is diminishing and may be even changing sign over time.	Found a significant negative influence of the Masculinity index on ERP penetration.	A significant positive influence on ERP penetration was found in the case of the Long-Term Orientation.
Yaveroglu and Donthu (2002)	IT adoption and diffusion	US, European countries, Taiwan, Japan	Empirical research	The coefficient of innovation is high in countries that are high on low on Power Distance	The coefficient of innovation is high in countries that are low on UAI. The coefficient of imitation is high in countries that are high on UAI.	The coefficient of innovation is high in countries that are high on IDV. The coefficient of imitation is high in countries that are low on IDV.		
Yeniyurt and Townsend (2003)	IT adoption and diffusion	Multiple countries	Empirical research	Power Distance hinders the acceptance of new products.	Uncertainty Avoidance hinders the acceptance of new products	Individualism has a positive effect on the diffusion of new products.	Masculinity dimension has no significant effect on the diffusion of new products.	
Yoo and Torrey (2002)	IT use and outcomes	Korea and US	Field study	Found significant differences (as predicted by national culture) in the manner that Korean and US consultants create, seek, share, and preserve knowledge.	Found significant differences (as predicted by national culture) in the manner that Korean and US consultants create, seek, share, and preserve knowledge.	Found significant differences (as predicted by national culture) in the manner that Korean and US consultants create, seek, share, and preserve knowledge.	Found significant differences (as predicted by national culture) in the manner that Korean and US consultants create, seek, share, and preserve knowledge.	

Adapted from Leidner and Kayworth (2006)

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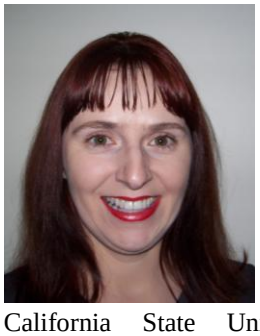

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